

GUTTA-PRODUCING TREES.

[The following interesting paper upon the trees which produce the "Gutta-percha"* of commerce has been placed at the disposal of the Society by the courtesy of Sir FREDERICK A. WELD, to whom it has been submitted by Sir HUGH Low, Resident of Pêrak.]

*Sir Hugh Low, Resident of Pêrak to the Hon'ble the Acting Colonial Secretary,
Straits Settlements, dated The Residency, Thaïpeng, Lárut,
12th October, 1883.*

SIR,—I have the honour to forward, for the information of His Excellency the Governor, a Report on the trees producing the "gutta percha" of commerce, by Mr. L. WRAY, Junr., Curator of the nascent institution which, it is hoped, may develop into a useful collection of the natural products of this State as the Pêrak Museum.

2. The collections, when at the commencement of the current year His Excellency appointed Mr. WRAY, were in a very embryonic state, and being aware of the careful habits of observation he had acquired as an amateur of considerable attainments in electrical and chemical science, and of his zealous pursuit of scientific knowledge in other directions, I requested him to devote his attention to collecting information as to the valuable product known as "gutta percha," together with complete series of specimens of the

* [The unknown person who first rendered the Malay word *gêtah* (sap, gum, bird-lime) by the Latin word *gutta*, deserves credit for some ingenuity. The accidental resemblance of the two words, and the adoption of the latter by botanists, may however be misleading as to the true derivation of the term "gutta percha." *Gêtah*, in Malay, is the generic term for any kind of sticky sap which exudes from trees, plants, leaves or fruit: *perchah* means a rag, bit or strip of any stuff. *Gêtah perchah* would thus mean *gêtah* in strips or pieces (after being boiled), as opposed to the semi-liquid and sticky condition of the raw substance.—ED.]

product, and the trees which produced it, such as might enable the eminent men of science at the Head of the Royal Institutions of Kew, Ceylon and Calcutta to botanically identify them.

3. Mr. WRAY has zealously and successfully carried out the instructions he received, and complete specimens of several species have been made available, and their receipt cordially acknowledged, and others are in course of preparation.

4. In addition to this, Mr. WRAY's scientific training has enabled him to discover that, by the wasteful means of collecting, which alone have been hitherto practised, by far the greater part of the valuable product for which the tree is destroyed remains in the bark which is left to rot in the jungle, so that not more than the merest fraction is made available for the demands of commerce.

5. The process necessary for extracting the whole of the gutta, Mr. WRAY describes as simple maceration of the fresh bark shred into thin slices, or of the bark dried and pounded, a process so productive of valuable results that he considers the quantity exported from the Straits Settlements might have been gathered from one-thirtieth of the number of trees which, it is estimated, must have been destroyed to produce it.

6. In Pêrak, the larger trees had been destroyed before my attention was attracted to the manner in which it was collected. The quantity exported was rapidly diminishing, when, in 1880, I advised the Government, as the only means of preventing the annihilation of the species, the young trees of which were being rapidly cut down, to forbid the export altogether.

7. Old trees had become so scarce that we had great difficulty in securing flowering and fruiting specimens, and I have, as noticed in the diary of my late expedition to the upper waters of the Pêrak River, ascertained that the central parts of the Peninsula cannot, in all cases, as has been supposed, be trusted to produce an inexhaustible supply. On the light sandy soils which prevail there, none of the "*gêtah taban*" trees are seen, and the natives assured me that although the kinds of India Rubber called "*gêtah rambong*" (*Ficus elastica*) and the "*gêtah senggârip*" (*Willoughbeia*) had been common, the *Dichopsis* or *Isonandra* and the *Payena*, which is nearly of equal value, were quite unknown. These were, how-

ever, very common on the ranges of mountains near to the Straits of Malacca and on the lands bordering the sea-coasts, where the climate is much more moist and the soil is a stiff clayey loam resting upon granite, while the lighter soils of Upper Pêrak are on slates, schists and other metamorphic rocks.

8. As the more economical mode of dealing with the product of the "gutta" trees brought to notice by Mr. WRAY—collecting the bark instead of the gum—will be of great importance to such States as still have a supply, I would recommend that Mr. WRAY'S Report be published in the Straits Settlements *Government Gazette* or in the Straits Branch of the Asiatic Society's Journal, so that, what there seems no reason to doubt, is a valuable economic discovery, which it is quite likely may be equally applicable to other gums or India Rubber-bearing trees, may be made known as widely as possible. It might even, with advantage to the commerce of the Straits Settlements, be translated into Malay.

HUGH LOW,
Resident, Pêrak.

*Mr. L. Wray, Jr., to Sir Hugh Low, Resident of Pêrak, dated the
25th September, 1883.*

SIR,—I have the honour to inform you, that in pursuance of the request you made some months ago, I turned my attention to the study of those trees from which the Gutta Percha of commerce is procured; and I now beg to present to you my Report, embodying the result of those studies up to the present time; and solicit your special attention to that portion which relates to my discovery of the large quantity of Gutta Percha that may be extracted from the bark, which is now entirely wasted.

I have sent botanical specimens, and, in most cases, samples of gutta and wood, of nearly all the trees I have mentioned, to the Royal Gardens at Kew, and also to the Royal Botanic Gardens, Calcutta, and the Royal Botanic Gardens, Ceylon; so that when the eminent botanists at those establishments have examined and compared the several specimens, the mystery in which their botani-

cal identification has been hitherto so completely enshrouded will, I venture to hope, be satisfactorily solved.

Gētah Taban Merah. . (*Dichopsis Gutta*, or *Isonandra Gutta*.)

This tree, from which the best kind of Gutta Percha is obtained, grows, or rather used to grow, throughout the jungles of the plains of Pêrak and a short way up the sides of the hills.

It seems to like a considerable amount of moisture, and will even grow with its roots in a running stream. It is a tree of large size, attaining a diameter of 4 to 5 feet, and a height of between 100 and 200 feet.

It has large thin buttresses around its base, which often present, on their upper portions, a convex profile, and, on a large tree, attain a height of 6 to 8 feet, and a span at the base of 4 to 5 feet from the trunk. As far as I have yet seen, they never form an arch, but have their lower parts buried in the earth, from the trunk to their extremities.

When growing in the forest, the tree has a clean, straight appearance, the former being due apparently to the bark peeling off in irregular pieces. The bark is of a rich brown-red colour, and from one-third to half an inch in thickness.

Inside the epidermis it is of an Indian-red tint; and when cut, the milk white sap oozes out, at first in small beads, which, enlarging, soon join and covers the injured part with a coating of a cream-like consistency. The leaves are lanceolate on a young tree, and roundish oval with abruptly acuminate points on a tree of mature growth. The margin is entire, and they are covered on their undersurface, with minute silky warm-brown hairs. The leaf stalks and young wood are also covered in a similar manner, which gives the whole tree, when looked at from below, a brownish tint, by which the tree may generally be recognised. The upper surface of the leaf is dark green, and the veins are not prominent.

The calyx consists of six sepals, three of which are superior to the others, and alternate with them.

They are coated, like the backs of the leaves, with silky-brown hairs. The corolla is white, and is divided into six petals. The style, which is simple, is sometimes persistent, and may be seen on

the ripe fruit. There are six ovules, but one or two seeds only arrive at maturity.

On the apex of the young fruit, the six carpels of which it is formed can be distinctly traced. The fruit is coated, like the backs of the leaves, with brown down; its flesh is soft, and it is sweet, but it has a disagreeable flavour of gutta percha.

The seeds are very oily, and they are, together with some of the seeds of nearly allied species, collected by the Malays and the Sakais, who dry them in the sun for some days, and then express the oil by putting them between two flat pieces of wood, and applying pressure by clamps and wedges.

The oil, which is solid at the ordinary temperature (that is up to 90°), is highly esteemed for cooking purposes. Birds, squirrels, monkeys, &c., are very fond of the fruit and of the seeds, which adds to the difficulty of obtaining them.

It flowers in the month of March, and ripens its fruit in June; but the Malays assert that it only fruits once in three or four years.

The gutta of this variety is red, and the colour is not due to an admixture of bark, as is frequently stated. It is probable that other varieties of gutta may be sometimes mixed with bark to make them look like *Taban Merah*, and so command a higher price than they otherwise would; but the true *Gĕtah Taban Merah* is red *per se*, and the water in which it is cleaned, although changed many times, still becomes deeply dyed with that colour. Specimens of this, in fruit, together with wood, bark, and gutta, I sent to the Royal Gardens at Kew, Calcutta, and Ceylon, on May 30th, 1883.

Method of collecting the Gĕtah Taban Merah.

A tree having been found, a staging of saplings, tied together with roots or rattans, is erected round it, so that it can be cut above the spreading buttresses. The tree is then felled with a little Malay axe called a "*bĕliong*," and as it lies on the ground, V shaped rings, about one inch broad, are cut in the bark, at intervals of 15 to 18 inches, all along the whole length of the trunk, and of the large branches, with a heavy chopping knife, called a "*parang*." These cuts soon become filled with the white cream-like sap, and

in about half an hour, the gutta will have separated from the aqueous portion of the sap, and may then be removed, by rolling a small ball of it round in the cuts, to the edge of which the coagulated gum adheres, and forms a disc, varying in size, according to the number of scores it is rolled in.

These discs are then boiled in water, and made into balls, and sold by the collectors to the men who export it to Penang or Singapore.

The gutta is, at first, pure white, but soon changes to pink, and finally to a brownish-red. The water in which the gum is boiled becomes a dark red-brown, and this colouration is the most distinctive feature that this variety of gutta possesses, and by which it may be easily recognised.

The air seems to have on the sap an effect analogous to that of rennet on milk, coagulating the gummy portions so rapidly, that only a small quantity of their watery stuff runs out of the cuts, all the gutta percha remaining as a soft spongy mass in the scores.

The amount of gutta obtained from a single tree, appears to have been greatly over-estimated in the accounts that have been written on the subject; and exceptionally large yields from gigantic trees have been erroneously quoted as being an *average* product, which is clearly by no means the case.

I had a tree felled, that was two feet in diameter (at six feet from the ground) and about one hundred feet high, the age of which I estimated, from its annular rings, to be over one hundred years. It gave only 2lb 5 oz. of fairly clean gutta, valued by a Malay dealer at \$1.20 per catty, or 3s. 3d. per pound, so that the product of this tree was worth only 7s. 6d.

Some say, that if gutta trees are felled in the height of the rains and when the sap is rising strongly, they then yield more gutta than at other times; but I have had no means of testing the truth of this assertion.

Gētah Taban Sutra. Dichopsis —.*

This tree is usually confused by the Malays with the preceding one, but is very different to it in many respects. It grows on low

* Sutra=silk.

hills, and, the Malays say, will only thrive in sight of water; and those I have seen certainly bear out this idea, for they were all near the bank of some stream, and at an elevation of about 500 to 600 feet above sea level.

It has much the same appearance as the *D. Gutta*, but the leaves are smaller, and their backs have a yellower shade of brown, and the buttresses are much smaller, and have a concave outline. The bark, which is dark brown, is smooth, and shews, by small oval indentations, the places where the branches have been, when the tree was young. This is a feature I have not noticed in any other gutta, and may, I think, be taken as characteristic.

The flowers have a reddish tinge, and the fruit is coated like the backs of the leaves, and is oval in form, and about the size of a mussel plum.

Its gutta is pale reddish-brown (like *Gĕtah Sundik*) and the water in which it is boiled does not acquire a red colour. It coagulates nearly as quickly as *Taban Merah*, and is collected in the same way.

The specimens I collected were obtained from the Ulu Kenering, Pêrak. The tree was 12 inches in diameter at 3 feet from the ground and was in fruit when felled on the 17th August, 1883. The flower was obtained by a Malay about 10 weeks previously.

Gĕtah Taban Puteh (White). Dichopsis Polyantha?

This tree cannot be told, by its outward appearance, from *Dichopsis Gutta*, except that its leaves are rather larger.

It has large buttresses, with convex tops, and the bark is nearly of the same shade, but rather browner. The fruit also seems to be similar, and the flowers are white; so that it is not until the tree is felled, that any very distinctive character appears. It is then found that the sap, which is much more copious, does not coagulate quickly, and when it does, it is of a dirty white colour, and has a much higher softening point than any of the other kinds, even boiling water not being sufficiently hot to thoroughly soften it. This tree grows on the hills, up to an elevation of 2,500 feet above sea level.

I have never seen it growing on the plains, nor in fact lower than 1,800 feet.

It ripens its fruit in the month of February.

The gutta is collected by felling the tree, ringing the bark, and placing leaves, bamboos, &c., under it to catch the sap; which is afterwards boiled, and the natives often add salt to hasten its coagulation.

It is frequently adulterated with the gutta from Kayu Jelutong, and two or three of the Bassias.

The usual method of mixing them is to do so before the sap has coagulated, as afterwards, owing to the high melting point of *Taban Puteh*, they cannot be so easily and intimately combined. A tree of ten inches in diameter, at four to five feet from the ground, gave 2lb 11oz. of fairly clean Gutta Percha.

Gĕtah Taban Puteh (Variety).

This variety differs from the above, in having smaller leaves, and in the shape of the fruit, which is longer in proportion to its breadth.

I have found it growing on the hills at 2,300 feet elevation; and it ripens its fruit in the month of February.

Gĕtah Taban Chayer. Dichopsis* —.

This tree I have found growing at 600 feet above sea level; and it attains a large size.

The bark is reddish-brown, and the wood is hard and white, with a dark red centre.

The backs of the leaves are, when young, of a golden brown, but full grown ones are silvery.

They have not the points of the leaves that are present in most other varieties of *Dichopsis*.

The flower, which appears about the middle of September, is pale green, and very small.

The corolla has a six-toothed limb, the teeth being nearly triangular in shape, and so thin as to be almost transparent.

* Chayer=liquid.

The diameter of the flower is about $\frac{3}{16}$ of an inch.

In the throat of the corolla are inserted, by short filaments, twelve anthers. They are placed alternately in the centre of the teeth, and at the junction between two teeth.

The style is simple, and of such a length that it projects beyond the petals, in an unopened flower bud. It appears to be often persistent.

The gutta coagulates very slowly, hence the native name "*Chayer*," which means watery, &c.

The gutta, which seems to be of good quality, is of a dirty white colour, but may be easily distinguished from *Taban Puteh* by its lower softening point, and the tree, by its having small concave buttresses.

Gĕtah Taban Simpor. Dichopsis Maingayi?

This tree may be readily distinguished from the foregoing by its large dark green leaves, and by its prominent veins at the back, which are covered by coarse, silky light-brown hairs, the back of the leaf itself being only sparingly covered by them.

The bark is about half an inch thick, rough, and of a reddish-brown colour, much covered by a greyish lichen. It has medium-sized buttresses with a concave outline.

One tree that I measured was three feet three inches in diameter, at six feet from the ground, and from that height the buttresses sloped out until they reached the ground; having a spread of about three feet from the trunk.

The flower is white, and comes out in the beginning of April, or the end of March; but its fruit I have not yet seen.

I had one tree felled, which, at three feet from the ground, measured seventeen inches in diameter, and sixty-three to the first branch. The weight of gutta obtained was 12oz. The sap, by the aid of heat and stirring, coagulated in twenty-three hours after tapping.

This gutta is sold under the name of *Gĕtah Puteh*. The tree grows on hills up to about the same height as *Taban Puteh*.

Gĕtah ——. Dichopsis ——.

This is very much like the foregoing, but the leaves are of a lighter green, and are not so much coated with hairs; the bark is smooth.

I have not yet seen the flowers, but the fruit is green, smooth, devoid of hairs, and ripens in August. I found it growing near the *Taban Sutra*.

Its gutta is slow in coagulating and softens at a lower temperature than the last named variety; and it becomes rather sticky when heated, and remains so for some time after it has cooled.

Gĕtah ——. Dichopsis ——.

This tree has large, glossy, dark-green leaves, the backs of which are coated with rich warm chocolate-brown hairs, more densely on the veins than elsewhere, and the midrib is coated, in a similar manner, on the top surface of the leaf, for about two-thirds of its length.

The bark is very rugged and greyish-brown in colour, containing so little gutta that it is not worth collecting. I have found it growing on hills, about 800 feet high; but, as yet have not been able to procure flowers, or fruit.

Gĕtah Taban ——. Dichopsis ——.

Trees of this variety are said to be growing on the Gûnong Miru range, near Kuâla Kangsa, to have small leaves, and to yield gutta of good quality; but I have not yet fallen in with it, nor have I had an opportunity as yet of collecting any specimens of it.

Gĕtah Sundik. Payena Leerii.

This variety grows in swampy places near the coast, and I found one tree with its roots in a small creek, the water of which was quite salt, and only a short distance from the regular Mangrove

trees fringing the stream. The leaves are small, shiny, and have a reddish tint when young. The bark is about three-eighths of an inch thick, and dark brown in colour, moderately rough.

The flowers are white, and the fruit is sweet, and eaten by the Malays. Its gutta is like Taban Sutra in appearance, and is collected by scoring the bark, catching the sap, and boiling it, until it coagulates. A tree measuring two feet and eight inches in circumference, at three feet from the ground, and $38\frac{1}{2}$ feet to the first branch, that I had felled, gave $6\frac{1}{2}$ oz. of gutta.

Gĕtah Sundik. Payena —.

This is a tree much resembling *Payena Leerii*, but differing from it in the leaves being longer in proportion to their breadth, the fruit and seed smaller, and the bark, which is reddish-brown, is only about one-half the thickness, and consequently the yield of gutta is much less (the yield seeming to be in proportion to the thickness of the bark). This variety, therefore, is less valuable commercially than the thick-barked kinds. I may observe that it grows in swamps, like the *Leerii*.

Gĕtah Gahru? Bassia —.

This is one of the Bassias, nearly allied to *B. Motleyana*; and it grows on the hills up to an elevation of 2,600 feet. The bark is light grey, and the wood seems to be of good quality.

The leaves are dark green, and the flowers white.

The fruit is reddish-brown, and covered with silky hairs, like that of *Dichopsis Gutta*.

The style is often persistent. Its gutta is white and hard, and is used only for mixing with better classes of gutta.

There are several other Bassias which yield gums that are used for mixing also; but I have not as yet obtained any botanical specimens of them.

Kayu Jelutong. Dyera —.

The gum from this tree, is known as *Gĕtah Jelutong*, and is employed in the same way as that from the various kinds of Bassia.

The word "*Kayu*," means *wood*, but it is at times used by Malays instead of "*Pokok*" a tree, where they consider that it sounds better.

This tree is one of the loftiest to be found in the jungle; and has blackish-grey bark (white inside) which yields great quantities of white sap when cut into. It bears large bean-like pods, in pairs.

Its leaves are green above, and bluish-white beneath, and arranged in whorls at intervals, with seven leaves in each. The wood is white and very soft, and is largely used by the Chinese for making coffins, for which purpose it is well adapted, as it is light, and decays very rapidly when exposed to moisture.

ON THE GREAT LOSS OF GUTTA, RESULTING FROM THE WASTEFUL MODE OF EXTRACTION EMPLOYED BY THE MALAYS.

Whilst engaged in collecting specimens and information respecting the gutta-producing trees of Pêrak, I was greatly struck by the exceedingly small amount yielded by even large trees, by the present Malay method of ringing the bark; which led me to an examination of the dried bark, with a view to ascertain, by a series of careful experiments, what proportion of the whole amount of gutta contained in a tree was actually left in the bark after the usual process of extracting it had been performed.

With this object, I had, on the 24th of May, 1883, a tree of *Gëtah Taban Simpor* felled, and scores cut in the bark, at distances of fifteen inches along the whole length of the trunk; and obtained 12 oz. of gutta. Some two or three days after, I had some of the bark removed, and on the 29th, I cut some of it up into thin slices, across the grain, and boiled them in water for a short time when I found that gutta had been expelled, and remained as a slight and irregular coating on the chips. This I picked off, and weighing it, I found the yield to be $3\frac{1}{2}$ per cent. of the weight of the wet bark operated on.

Encouraged by this simple and satisfactory experiment, I next had a weighed sample of bark pounded in a mortar, and then transferred it to a glass vessel, and boiled it in water.

In a few minutes, the gutta formed itself into small detached

white flakes, and by stirring, collected into a mass, which was easily removed from the flask, and purified by reboiling in clean water. By this method, the sample of *wet* bark yielded 5.3 per cent. of clean white gutta.

Another weighed sample of bark, was cut up and dried in the sun, and then put into chloroform, and after standing some hours, with frequent shakings, the liquid was poured off, and allowed to evaporate; fresh chloroform being added to the bark to extract any gutta which remained in it. The total product thus obtained was 5.7 per cent. of the weight of *wet* bark used in the experiment.

I next took a weighed sample of wet bark and cut it up into small chips, and dried it thoroughly, and found as the result of several experiments, that it lost 50 per cent. of its weight in the process.

The following deductions may be made from these results:—*Firstly*, that the wet bark, which is now allowed to rot in the jungle, contains fully 5.7 per cent. of its weight of Gutta Percha, or when dried 11.4 per cent.; and *secondly*, that by simply pounding or rasping, and boiling the bark, nearly all the gutta which it contains may be extracted.

After the tree was felled, I made careful measurements of it, and weighed portions of the bark, so that I could calculate the total weight on the trunk of the tree, up to the first branch, which I found to be 530lbs. when in the wet state.

Now if we take 5.3 per cent of this, as being the amount of gutta, that may be extracted by the process of pounding and boiling, already specified, we find that it would yield 28lb. over and above the 12oz. which were obtained by the ordinary Malay method; or, to put it in another way, that for every pound of gutta collected at present, 37lb. are wasted!

In the Kew Report for 1881, I find it stated, that in the year 1875, the export of gutta from the Straits Settlements and Peninsula, was estimated at ten millions of pounds weight.

I have no means of ascertaining the accuracy of that estimate, but accepting it as being tolerably correct, we must, from my experiments, come to the conclusion, that even if we take the amount of gutta wasted, at only thirty times the weight of that collected,

there were, during *that one year*, no less than three hundred millions of pounds, or putting the price at only 2s. 6d. per pound, £37,500,000 sterling worth of Gutta Percha thrown away, and utterly lost!

To fully realize the importance of this subject it must be borne in mind, that this vast destruction of these valuable trees (which are of such very slow growth) and of this *material*, on which the communication of the world may be said in a measure to depend, is going on *every year*, without any cessation whatever.

It will be noticed, that I have left out of my calculations, all the bark on the upper part of the trunk, and on the branches, which however is just as rich in gutta, as the lower portion of the trunk: even the leaves contain a notable proportion. I have tested, also, other varieties of these trees, and have obtained almost identical results, therefore I need not enter into further details.

The question naturally arises, can the bark be broken from the trees, and dealt with in the country, or can it be dried and sent to Europe, to be ground up and treated in the manner I have described, or in some other way sufficiently economical, as to be commercially successful? This question deserves the most anxious attention, especially of those who are engaged in the working up of this material; for if it can be successfully accomplished, then the same supply could be furnished, with *one-thirtieth* of the present annual destruction of trees!

With the object of having this point so far tested, I have collected some bark, and am sending it to the Royal Gardens at Kew, with a request to have it sent to one of the large manufacturers, so that a report may be obtained from them on the subject.

The labour involved in stripping the trees, carrying out the wet bark from the jungles (where no roads, or even paths, exist), drying it, carrying it to a port, and thence to England, are items of expense, which must not be overlooked. At the same time, it must also be remembered, that some other jungle products, quite as bulky, and not so valuable, are yet exported with profit.

If the gutta contained in the bark can be profitably extracted, the planting of those trees on waste lands, might possibly be undertaken by Government, with every prospect of success.

The variety that seems to be most easily grown, is *Payena Leerii* (Gétah Sundik).

This tree fruits freely, and will thrive on the swampy plains near the coast; and is said by the Malays to grow fast. Its wood is hard, with a close grain, and takes a good polish, therefore may be of some value as timber.

I have tried experiments in making cuttings of some of the *Dichopsis*, but have not had any success as yet; although it is probable that they may be propagated by this means, when the proper mode of effecting it is found out.

I have not tried *Payena Leerii* as yet, but hope to be able to do so very shortly.

L. WRAY, JUNR.
